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Belt and Road Initiatives and the Competitiveness of Natural Rubber Exports: Evidence from the BRI Region*

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Abstract

This study examines the export competitiveness of four major natural rubber exporters in the Belt and Road Initiative (BRI) region and investigates the factors affecting bilateral natural rubber export. This study utilized the revealed symmetric comparative advantage (RSCA) to measure export competitiveness. Next, this study employed the gravity model using the Poisson Pseudo Maximum Likelihood (PPML) estimation to analyze the factors affecting bilateral export from the four major natural rubber exporters to 46 countries in the region. The analysis is conducted by using annual data from 2001 till 2018. The findings showed that all four major exporters maintained their export competitiveness. Indonesia and Vietnam notably exhibited increasing trends in the early 2000s. Besides, the market share for Malaysia and Vietnam have increased from 2013 to 2015 with the BRI implementation in 2013. In addition, this study discovered that non-tariff measures (NTM) have a positive and significant impact on the bilateral export of natural rubber. The overall findings strongly indicate that the natural rubber export has increased post BRI announcement. The outcome highlighted the benefits of BRI implementation on the natural rubber export. This study is the first attempt to apply the gravity model on the natural rubber exports within the BRI region.

Keywords: Natural Rubber, Export, Comparative Advantage, Belt Road Initiative, Gravity Model

JEL Classification Code: F14, F15, Q17

1. Introduction

The recent globalization trend has led to intense competition and is inevitable as the world today experiences challenging and highly complex international trade. The rapidity of global trade has caused countries worldwide to analyze the economic growth in-depth. The competitiveness concept is often used to analyze economic development to avoid being left behind in this modern era (Capobianco-Uriarte et al., 2019). According to Barone and Kreuter (2021), trade globalization is one of the most crucial potential economic indicators that significantly impact the structure of the labor market system and the country. Customarily, businesses with large production inevitably dominate the productivity distribution of domestic firms in a country (Eaton et al., 2011). The global trade opened to a new stage branch initiated by China, known as the BRI or One Belt One Road (OBOR), which targeted to improve regional cooperation and connectivity on a trans-continental scale. The initiative aims to strengthen infrastructure, trade, and investment links between China and 65 other countries that collectively account for over 30% of global gross domestic product (GDP) and 62% of the world population. The BRI covers trade through the land and maritime via the Silk Road Economic Belt and the New Maritime Silk Road. Furthermore, BRI has tremendous potential to be tapped by the countries involved as the initiative transforms the economic environment in which economies in the region operate. Improved infrastructure and enhanced regional cooperation could substantially reduce trade costs and improve connectivity, leading to higher cross-border trade, investment, and economic growth in the region (He et al., 2021).

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Market integration has resulted in significant growth in commodity goods such as natural rubber as production inputs. Competition in natural rubber production becomes more transparent as producers and countries try to capture market demands, leading to a higher return to scale with increased production and decreased cost. Several major natural rubber exporters among the BRI countries are Thailand, Indonesia, Vietnam, and Malaysia, responsible for over 73% of natural rubber production globally (Kennedy et al., 2017; FAO, 2020). The natural rubber export values for Thailand, Indonesia, Vietnam, and Malaysia in the world market and BRI countries in 2018 are shown in Table 1. These four countries are observed to be among the world's largest natural rubber exporters. The countries' combined export share is equivalent to 81%, and they also capture 84% of the natural export share to BRI countries. Furthermore, in terms of BRI countries' export ratio to the world, more than half of the exports from Malaysia (64%), Vietnam (55%), and Thailand (54%) are to BRI countries. The situation signifies the importance of BRI for each country.

Natural rubber plays a significant role in the domestic economy as an essential plantation commodity for most countries and employment sources. In addition, this commodity also contributes significantly to foreign exchange. For instance, the significant contribution of the rubber industry to foreign exchange in the last five years equals 25 to 40% of total plantation products exports (Gapkindo, 2016). In addition, rubber exports contributed to spurring the growth of new economic centers in rubber development areas. Besides contributing towards higher export revenues, rubber plantations are mostly smallholder estates and function as income sources for millions of rubber farming families. Thus, the rubber industry significantly contributes to the socio-development of smallholders. Hence, high natural rubber prices can lead to higher income for smallholders. Rubber price fluctuates due to the demand and supply in the global market. Rubber is a versatile and flexible material that has become increasingly popular in the medical field over the years. Thus, strong demand and increased natural rubber usage in modern medical industries for making various items such as surgical gloves, tubing, stoppers, breathing pads, fabrics that protect or support, prosthetics, implants, and catheters have dramatically boosted the rubber industry.

As explained earlier, BRI may improve the connection between countries, lead to higher trade, and open more significant opportunities for the natural rubber market. However, many higher competitiveness risks could harm certain countries' export. Besides competition from major natural rubber exporters, rising competition is emerging from the biggest syntactic rubber exporter among BRI countries: China, Europe, and North America. This research aimed to focus on BRI countries as BRI may improve the connection between the significant natural rubber exporters and other BRI countries, leading to greater opportunities for the natural rubber market. Thus, the current study aimed to address few questions rising from the discussed situation:

i. What is the current level of natural rubber export competitiveness within BRI countries?
ii. What are the aspects that influence natural rubber export?
iii. What are the implications of BRI implementation on natural rubber export?

Hence, the study analyzed the competitiveness of major rubber exporters in the BRI countries and investigated the determinant of natural rubber exports within BRI countries. This study utilized the RSCA to analyze export competitiveness and subsequently employed the gravity model to investigate the determinant. The remainder of the paper is organized as follows: Section 2 discusses previous literature on natural rubber trade concerning competitiveness, whereas Section 3 elaborates on the data source and methods employed. Section 4 reports estimation results, while the conclusion is discussed in Section 5.

Table 1: Natural Rubber Export to World and BRI Countries

Country	World		BRI		Ratio Export BRI to World
	Export Value	Share	Export Value	Share	
Thailand	4,602,170	36%	2,495,751	43%	54%
Indonesia	3,951,451	31%	1,231,326	21%	31%
Vietnam	953,654	7%	521,494	9%	55%
Malaysia	935,093	7%	600,681	10%	64%
Total	10,442,368	81%	4,849,252	84%	46%

Source: Author's calculation based on COMTRADE (2021).

2. Literature Review

Many previous studies have discussed the theoretical compass that drives competitiveness in businesses and trade. Technology has played an effective role in reducing operating and transportation costs, speeding up manufacturing processes, enhancing accessibility and trade in services (Amiti & Wei, 2005; Abramovsky & Griffith, 2006; Blinder, 2006; Kersan-Skabi, 2019). In the 21st century, the fourth Industrial Revolution has a profound impact on international trade. Advanced technologies such as artificial intelligence (AI), robotics, big data networks, Internet of Things (IoT), and fast computer analytics forecasting are important factors to gain competitiveness in the market (Bertola & Teunissen, 2018). The government can play a crucial role in supporting their own country (Mesquita et al., 2007) by assisting the companies in lowering expenses and improving competitiveness through the development of clear standards and quality control and financially supporting design, marketing, and technology transfer programs for a group of firms in a particular business (Altenburg & Meyer-Stamer, 1999).

Njinyah (2018) studied 101 small and medium-sized enterprises (SME) cocoa exporters in Cameroon. The study results found that government policies positively impact SME cocoa exporters' performance. Thus, the government can be a solid external ally to the international trade to be sustainably competitive in terms of financial support for SMEs to overcome impediments in exporting caused by a lack of resources (Gençtürk & Kotabe, 2001). Various methods have been employed in many empirical studies to measure trade competitiveness. For example, Boffa et al. (2021) utilized a combination of the Global Value Chains (GVC) and International Trade Centre (ITC) competitiveness index in their study. Utilizing the dataset panel approach, they demonstrated the competitive effect between small and medium firms compared with large firms regarding productivity distribution in international trade activities. The ITC competitiveness combination score for small, medium, and large firms was collected from multi-regional input-output tables to produce a panel dataset at the country and company category level with global value chain participation measures. The exciting conclusion from the research has demonstrated that small businesses benefit more from value chain integration than large businesses (Boffa et al., 2021). Falciola et al. (2020) demonstrated that the ITC focused on checking the firm competitiveness in three sections: complete, connect and change. The "complete" aspect focuses on current operations, which enable companies to compete statically, whereas the "connect" aspect addresses the relevance of connecting to data channels in a competitive setting. Finally, the "change" aspect relates to adaptation and change required to ensure adequate and sustainable results.

The GVC refers to producing goods in stages across numerous countries that specialize in specific manufacturing process stages. The theory has evolved in tandem with the dynamic flow of knowledge, where a new version of the model has emerged in terms of countries, types of workers, sectors, levels, and occupations. The second version of GVC is a highly proven, more accurate measure for the production on stage two than stage one, which is a general estimation level of the manufacturing process (Lee et al., 2018). The GVC method has become one of the most popular indicators in estimating the spread of production processes, especially for highly dynamic trading (Kersan-Skabi, 2019). Disadvantages of the GVC method are evident if many companies rely on the same small group of producers. The risks may spread rapidly throughout the production chain (Acemoglu et al., 2012). Furthermore, the country has a high risk of exerting shock on the environment (Stellinger et al., 2020; Boffa et al., 2021).

One of the most favorable methods in conducting competitiveness research is utilizing the revealed comparative advantage (RCA). The RCA and RCA1 indices are almost identical in measuring a country's global trade competitiveness based on comparative advantage (Balassa, 1977). The RCA indices are frequently used to analyze a commodity's competitiveness on the global trade and compare the competitive advantage of a product exported from various production regions (Nin et al., 2007). However, RCA1 is intended to easily show competitiveness where values below one are considered less competitive or lose competitiveness. The RCA1 is the RSCA concept with the formation rate from –1 to 1, with the value 0 indicating a comparative export advantage, whereas the value of –1 implies a comparative export disadvantage. A potential bias can be eliminated because the RSCA distribution is symmetric around zero (Dalum et al., 1998; Baquero et al., 2006; Balogh & Jambor, 2018). The RCA index can explain export opportunities in the business market through incentives and not solely by observing comparative advantages (Vollrath, 1991; Kreinin & Plummer, 1994; Dalum et al., 1998; De Benedictis & Tamberi, 2004; Hoang, 2020).

Many analysis methods are available to measure the competency level of products and between countries globally. The comparable analysis research indicated that foreign trade openness would drive a sustainable economy since the analysis is particularly effective in sustaining long-term growth for agro-industry and agribusiness by obtaining more competitive added-value (Burianova & Belova, 2012). Prior to the big-scale revolution and booming of trade globalization, agro-based production was only small-scaled. However, the agriculture industry has transformed into a profitable economic generator less concerned with environmental and social regulations due to the tremendous expansion in operations (Buck et al., 1997; Murray &

Raynold, 2000). Rubber is one of the crucial agricultural products and contributes to Sumatra's economic growth in Indonesia (Svatos et al., 2018; Huo et al., 2019). Bucur et al. (2019) analyzed taxation and economic growth in Romania in terms of rubber commodities. Results showed that tax negatively impacts the financial position of rubber firms but improves Romania's economic growth and positively impacts the companies' sustainable development.

The price volatility remains a vital issue among rubber farmers. Due to extreme rainfall, their inability to gain consistent income will negatively affect rubber production (Mesike & Esekhade, 2014). The scenario may worsen for the farmers when the global economic decline indicates a high condition of risks due to the low demand for rubber and the lowest market rubber price recorded in 30 years (Ghazali et al., 2015). Thus, the significance of the research in this particular area is focused on reducing the risk for the farmers. A cointegration framework was used in the study of natural rubber in India, and it was discovered that the 'expectancy theory' validity of commodity future pricing for commodities with high price volatility, such as rubber and spices, is still valid. According to the latest findings, the appropriate hedging ratio for protecting market farmers and lowering the risk of commodity price shocks is determined by large differences in hedging efficiency between markets (Nair, 2021).

Studies concerning the competitiveness of natural rubber have been undertaken previously. For instance, Tanielian (2018) focused on the competitiveness between rubber and profit gain among rubber farmers in Thailand. The researcher highlighted that the farmer's inflation cost operation could not cover the profit gain from the rubber production during dramatic price drops, specifically with the rubber market price established by the Thai government, to cover those costs. Other research on rubber competitiveness focused on the orientation and increasing added-value of natural rubber products by using the Strength, Weakness, Opportunity, and Threat (SWOT) analysis; Ergonomics Systemic, Holistic, Inter-disciplinary, and Participatory (SHIP) approach and appropriate technology. The findings revealed that natural rubber exporting countries competed in the global rubber market through high-tech innovation that encourages markets to adapt, add value, and eradicate poverty by focusing on small and medium-sized rubber enterprises (SMEs) (Setiawan, 2012). The research concerning the competition in the rubber export market utilized the Lafay Index to measure rubber export competitiveness. In contrast, the Diamond model was used to model factors that affect competitiveness.

The findings also indicated that Indonesia's rubber goods export to the Association of Southeast Asian Nations (ASEAN) have become less competitive. The most significant declines were evident in Singapore, Malaysia, and Thailand because the quality of rubber-based goods is at a low level and no longer at the highest level in the import composition of ASEAN countries that can produce consumer goods with higher added-value (Ansonfino et al., 2021). Nevertheless, no study shows the competitiveness between the four biggest natural rubber exporters associated with the BRI countries. This study provides significant implications for the region's and other similar emerging economies' theoretical literature and managerial practice.

3. Research Methodology

This study comprises two parts wherein; the first part analyses the competitiveness for the natural rubber sector among the major exporter, namely Thailand, Indonesia, Vietnam, and Malaysia. There are several approaches to measuring competitiveness, and among these are the producer and market approaches. The producer approached measures competitiveness from the producer side using indicators such as price (Durand & Giorno, 1987) and exchange rate (Helleiner, 1991). Meanwhile, the market approach uses indicators such as market share or the change in market share (Fagerberg, 1988; Mandeng, 1991; Török, 2008). In this study, the market approach will be employed as it is based on export shares. Thus, when a country has a greater market share or experiences an increase in market share, it can be inferred that the country is competitive concerning the product in a certain period and area.

Hence, to calculate the market share of Thailand, Indonesia, Vietnam, and Malaysia's natural rubber export in Belt & Road Initiatives (BRI) countries, this study used the Revealed Symmetric Comparative Advantage (RSCA) as an indicator of competitiveness. RSCA is measured using the export share of a sector for a country's total exports and divided by the world's export proportion of the same sector to total world exports. This calculation can show the benefits of one country compared to other countries in international trade (Balassa, 1965). The formula for RSCA is as follows:

$$\mathrm{RSCA}_{in}^{t} = \left[\left(X_{in}^{t}/X_{i}^{t}\right)/\left(X_{wn}^{t}/X_{w}^{t}\right)-1\right]/\left[\left(X_{in}^{t}/X_{i}^{t}\right)/\left(X_{wn}^{t}/X_{w}^{t}\right)+1\right] \quad (1)$$

where RSCA_{in}^{t} is the revealed symmetric comparative advantage for country i for product n at year t; X_{in}^{t} is the export for country i for product n at year t; X_{i}^{t} is the total export for country i at year t; X_{wn}^{t} is the world export for product n at year t; X_{w}^{t} is the total world export at year t. RSCA_{in}^{t} has a range between a negative one and a positive one, where if RSCA is more than zero, the country has a comparative advantage in that product, otherwise for less than, zero. Product n in the current study refers to natural

rubber. This study calculates the RSCA by using annual data from 2001 till 2018, with three years average to minimize any year-specific shocks.

In the second part, this study investigates the determinant of natural rubber export in BRI countries by using the gravity model. Jan Tinbergen first introduced the gravity model of trade in 1962, where he clarified that the trade flows between countries can be explained by utilizing Newton's theory of gravitation (Tinbergen, 1962). Various researchers have utilized the gravity model of trade in explaining trade flows between nations as it is considered one of the economists' most reliable empirical relationships (McCallum, 1995; Feenstra et al., 2001; Anderson, 2011; Allayarov et al., 2018; Lundmark, 2018; Nguyen et al., 2020). This is due to the stability of the gravity equation and its ability to explain bilateral trade flows, which led to the development of theories and the model's significant incorporation.

According to Tinbergen (1962), the standard gravity model is specified as written below:

$$X_{ij} = Y_i Y_j / t_{ij} \tag{2}$$

where X_{ij} are the bilateral export values from country i to country j; Y_i and Y_j are the income for country i and country j, respectively; and t_{ij} is the trade cost between two countries, such as the bilateral distances. This study augments the basic model by including several proven essential control variables in the gravity model (Tham et al., 2018). Moreover, to address heterogeneities between countries, panel data is utilized. Hence, the basic model is augmented by including these variables and converted into a panel dimension in logarithmic form as follow:

$$\begin{aligned}\ln X_{ijt} = {} & \beta_0 + \beta_1 \ln \mathrm{GDP}_{it} + \beta_2 \ln \mathrm{GDP}_{jt} + \beta_3 \ln \mathrm{Pop}_{it} \\ & + \beta_4 \ln \mathrm{Pop}_{jt} + \beta_5 \ln \mathrm{Dist}_{ij} + \beta_6 \ln \mathrm{EXR}_{it} + \varepsilon_{ijt}\end{aligned} \tag{3}$$

where ln denotes variables in the natural logs form; X_{ijt} is the export from country i to country j at time t; GDP_{it} and GDP_{jt} are the income for country i and country j at time t, respectively; Pop_{it} and Pop_{jt} are the population for country i and country j at time t, respectively; Dist_{ij} is the distance from country i to country j; EXR_{it} is the exporter's exchange rate at time t; and ε_{ijt} is the error term.

Since not all of the countries in the world trade with each other, usually, trade datasets consist of a large number of zero trade flows. Silva and Tenreyro (2006) showed that estimating the model with OLS would lead to biased and even incontinent results in the presence of zero trade flows. Instead, they suggest estimating the model in multiplicative form by using the Poisson Pseudo Maximum Likelihood (PPML) estimator. Another study by Silva and Tenreyro (2011) further confirmed that the PPML performs well even when the proportion of zero trade flows are large in samples. To incorporate the impact of current trade policy, the standard model is transformed into exponent form and expanded to add trade barriers as follows:

$$X_{ijnt} = \exp\{\beta_0 + \beta x + \beta_7 T_{ijnt} + \beta_8 \mathrm{NTM}_{ijnt}\}\, \varepsilon_{ijt} \tag{4}$$

where x denote the vector of dependent variables as in equation (3); T_{ijnt} is the average tariff rate imposed on country i by country j for product n at time t; and NTM_{ijnt} is the dummy variable for non-tariff measures imposed on country i by country j for product n at time t.

The main focus of this study is to see whether BRI implementation influences natural rubber exports. Thus, this study includes a dummy variable to represent the year BRI start in the model as follow:

$$X_{ijnt} = \exp\{\beta_0 + \beta x + \beta_7 T_{ijnt} + \beta_8 \mathrm{NTM}_{ijnt} + \beta_9 \mathrm{BRI}_i\}\, \varepsilon_{ijt} \tag{5}$$

where BRI_t is a dummy variable with the value one indicating the year 2013 and onwards, while zero indicating before 2013. Similar indicators have been used by Görg and Mao (2020). Although the BRI details are only announced in 2015, based on the results identified in 2013, the firms have been made aware of the proposed policy and gaining to be more competitive. This study considers equation (3) as the base model, equation (4) with trade policy, and equation (5) is the most comprehensive as it also includes a dummy for BRI. Thus, this study estimate equation (3), (4) and (5) by using the PPML estimator. Following Baltagi et al. (2014), this study also includes time fixed effects (τ_t) to the model to account for time-specific events, such as the economic crisis.

From these estimations, the relationship between export and exporter's income is expected to be negative as an increase in exporter income will increase the domestic demand, thus lowering export. Meanwhile, the importer's countries' income was expected to have a negative relationship as an increase in the importer's income will increase the demand for imported products (higher export). Exporter's population can either have positive or negative impacts. When the population of the country increases, then there is a tendency for export to increase (higher production capacity) or decrease (higher domestic demand). The inverse can be said for the importer's population. Similar to the gravity model, distance is expected to be negatively related to export as it is a proxy for transportation costs between countries. Tariffs are expected to have negative impacts on bilateral export. NTM on the other hand, can either enhance or deteriorate export. While for the BRI dummy, this study expected to

find a positive impact, showing that BRI implementation increased natural rubber export for the major exporter with other BRI countries.

This study uses panel data which involves data for 18 years period from 2001 till 2018 and includes bilateral export data of four natural rubber producers: Indonesia, Malaysia, Thailand, and Vietnam, to 46 countries that were expected to participate in the BRI based on a Worldbank study (Baniya et al., 2019). Although according to Baniya et al. (2019), there are 66 countries that are expected to involve in BRI, this study removed some countries due to data unavailability. This study obtained the bilateral natural rubber export data for 18 years period from 2001 till 2018 from the COMTRADE database (COMTRADE, 2021). Data for GDP, population, and the exchange rate was obtained from Worldbank's world development Indicator database (World Bank, 2021). Meanwhile, the data for the bilateral distance between two capital was obtained from the CEPII database (Head & Mayer, 2013; Mayer & Zignago, 2011). Data for the ad-valorem tariff for natural rubber was obtained from the MacMap database (International Trade Centre). The data for NTMs implementation in the importing nations was obtained from the TRAINS database (UNCTAD, 2021). Table 2 shows the overall variable description, data sources, and the expected sign.

4. Results

The outcome of this study comprises two parts. These first parts discuss the results of the revealed symmetric comparative advantage (RSCA), while the second part elaborates on the gravity model analysis. For the first part, the competitiveness results are reported by exporters for an average of three years for six intervals, as shown in Figure 1. It can be seen that the average RSCA values for the four exporters are positive, which means that these four countries have a comparative advantage on natural rubber export to BRI countries. However, there are downward trends for Malaysia and Thailand and an average increasing trend for Indonesia and Vietnam. This means that Malaysia and Thailand are losing competitiveness in the current study period, while Indonesia and Vietnam are gaining more market share.

There are significant changes for Malaysia and Vietnam from 2013 to 2015, which can be attributed to BRI implementation in 2013. Hence, this study can conclude from the RSCA that Indonesia, Malaysia, Thailand, and Vietnam had a comparative advantage in the natural rubber market in the BRI region. However, the shares fluctuate and show that there are some other factors that influence the bilateral export within the region. Thus, to empirically

Table 2: Variables Description

Variables	Description	Sources	Expected Sign
X_{ijnt}	Bilateral natural rubber export values from exporter to BRI countries, in US$	COMTRADE (2021)	
GDP_{it}	Exporter's gross domestic product (GDP), in US$	World Bank (2021)	−
GDP_{jt}	Importer's gross domestic product (GDP), in US$	World Bank (2021)	+
Pop_{it}	Exporter's total population	World Bank (2021)	−
Pop_{jt}	Importer's total population	World Bank (2021)	+
$Dist_{ij}$	Bilateral distance between exporter and trading partner	Centre d'Etudes Prospectives et d'Inform'tions Internationales (CEPII)	−
EXR_{it}	Exchange rate for exporter's currency per US dollar	World Bank (2021)	−
T_{ijnt}	Bilateral tariff rate imposed by importers towards exporter for product natural rubber product	International Trade Centre	−
NTM_{ijnt}	Dummy for non-tariff measures, where 1 indicates existence of NTM between importer and exporter, zero otherwise	UNCTAD (2021)	+ / −
BR_{it}	Dummy for a year after BRI implementation, 2013 and afterward take the value one, meanwhile, before 2013 take the value zero	Görg and Mao (2020)	+

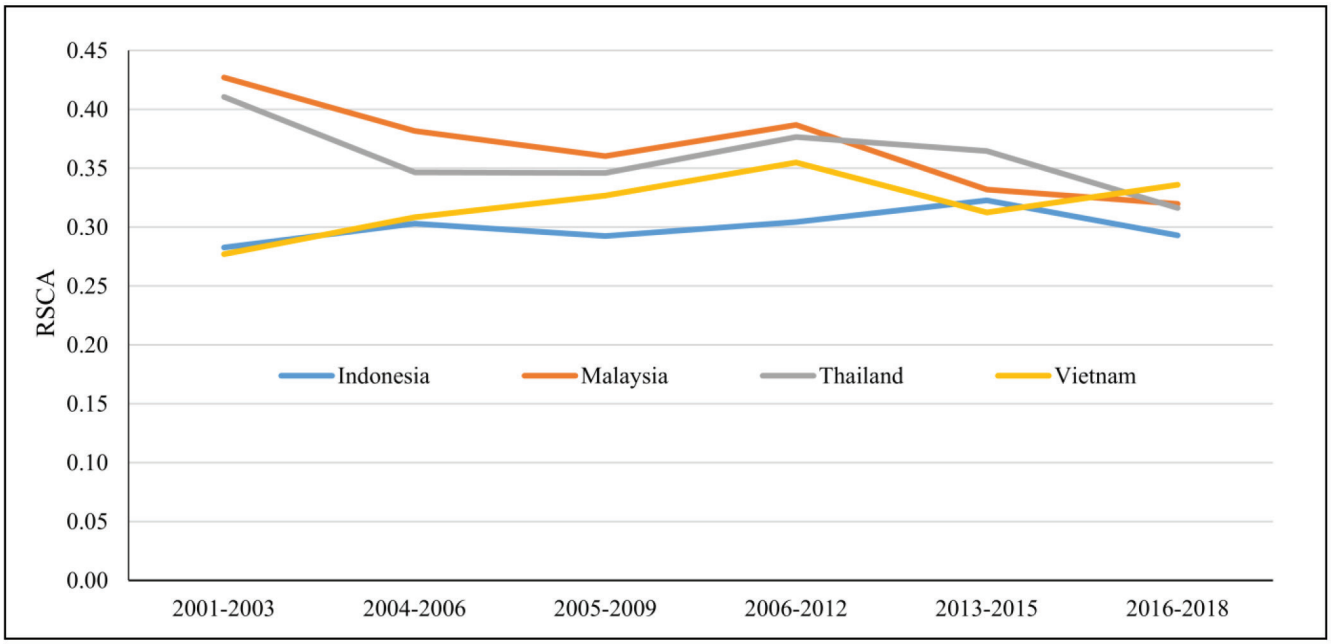

Figure 1: Average RSCA by Period

evaluate the impacts of BRI implementation and how the factors affect export for natural rubber, this study proceeds to the second part, which has been done by conducting econometric estimation.

Table 3 presents the descriptive results for the variables included in the model. Overall, it can be seen that most variables have low standard deviation except for export, and this is due to the nature of the data at US$ (not log) and the wide range of export data, from zero to 4,685,551. This is supported by the similar findings of past empirical studies that used PPML estimation (Wood et al., 2019; Jagdambe & Kannan, 2020; Yu et al., 2020; Zainuddin et al., 2020). In addition, this study utilizes multi-dimensional panel data with the total number of observations equal to 3,312 (4 exporters x 46 trading partners x 18 years) and having plenty of zero export. This supports our argument to use PPML estimation to overcome zero trade issues. All other variables also have low minimum and maximum values. The mean for NTM shows that between the average, 19.1% of countries in our sample implement NTM on natural rubber export. The dummy variables are not logged to provide better results interpretation.

Next, this study reports the PPML estimation results in Table 4. The high R^2 values of most models indicate that the current estimation results are reliable. Overall, it can be seen that the coefficient and sign obtained for all three models are consistent and thus proves the robustness of the results. The regression results align with the gravity model as most of the coefficients display the expected signs. A positive sign for exchange rate is expected as the increase in exporter's exchange rate should increase export due to lower export prices. This study shows that tariffs have no significant impact on natural rubber export. This can be due to the existing low tariff on natural rubber among BRI countries. This also highlights that tariff is no longer the dominant trade policy measure. Hence, the NTM dummy included in our model overcome this limitation.

Table 3: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
X_{ijnt}	25,023	187,108	0	4,685,551
$\ln GDP_{it}$	26.356	0.731	24.837	27.768
$\ln GDP_{jt}$	24.598	1.741	20.310	30.017
$\ln Pop_{it}$	15.960	1.835	12.540	21.055
$\ln Pop_{jt}$	18.179	0.774	16.959	19.405
$\ln Dist_{ij}$	8.554	0.656	5.754	9.279
$\ln EXR_{it}$	5.931	3.611	1.118	9.949
$\ln T_{ijnt}$	0.047	0.068	0.000	0.359
NTM_{ijnt}	0.191	0.393	0.000	1.000
BR_{it}	0.350	0.477	0.000	1.000

Table 4: Estimation Results Based on the Poisson Pseudo Maximum Likelihood (PPML) Regression

Variables	Base Model	With Trade Policy	With BRI Dummy
$\ln GDP_{it}$	−0.329** (0.154)	−0.329** (0.154)	−0.329** (0.154)
$\ln GDP_{jt}$	0.495 (0.302)	0.707** (0.354)	0.707** (0.354)
$\ln Pop_{it}$	−3.223*** (0.936)	−3.374*** (1.002)	−3.374*** (1.002)
$\ln Pop_{jt}$	2.023*** (0.233)	2.023*** (0.232)	2.023*** (0.232)
$\ln Dist_{ij}$	−0.624*** (0.100)	−0.624*** (0.100)	−0.624*** (0.100)
$\ln EXR_{it}$	−0.477*** (0.040)	−0.477*** (0.040)	−0.477*** (0.040)
$\ln T_{ijnt}$		1.874 (1.481)	1.874 (1.481)
NTM_{ijnt}		0.423** (0.208)	0.423** (0.208)
BR_{it}			1.443*** (0.415)
Constant	51.951** (22.346)	48.664** (22.123)	48.664** (22.123)
R^2	0.967	0.967	0.967

Note: *, **, and ***Represent significant level at 10%, 5%, and 1%, respectively. Standard errors in parentheses. Country-pair fixed effect and time fixed effect have been included in the model.

This study finds that the NTMs dummy has positive and significant impacts on the bilateral export of natural rubber. This shows that NTM is not inherently bad as it can also lead to higher trade. NTM has been proven to help solve market externalities issues such as asymmetric information and help improve product quality (Jaffee & Henson, 2004; Beghin et al., 2015). Thus, the positive sign is justified. Meanwhile, for the main focus variable in the current study, BRI dummy, estimations results shows that the bilateral exports for natural rubber from the top four producers to BRI countries have increased significantly post-BRI implementation. One way to explain these relationships is that the BRI announcement led firms and policymakers to engage more with trading partners to ensure all parties gain from BRI implementation (Görg & Mao, 2020). In addition, the infrastructure investment made by China government within BRI countries led to higher economic growth in the region, which also contributes to the positive impact (Iqbal et al., 2019). Thus, the finding from this study proves that BRI helped boost the natural rubber export for the major producers among BRI countries.

5. Conclusion

This study analyzed the competitiveness of natural rubber export using the RSCA approach and investigated the determinant of natural rubber export within the BRI region using the gravity model. The RSCA index indicated that the four major exporters of natural rubber had maintained the comparative advantage in the BRI region. However, the fluctuating index indicated the existence of several external factors that influence the bilateral trade flows. The output from the gravity model that used PPML regression had shed some light on this aspect. The exchange rate affects the natural rubber export positively in accordance with the theory. Tariffs are proven to no longer be the dominant trade policy measures as NTM plays these roles. The positive NTM impact should be interpreted cautiously as the positive impact does not indicate that the policymakers should enforce more regulations. Nevertheless, product quality can improve if these regulations are met and help boost export. Hence, efforts should be directed towards higher regulatory convergences in the region and reduce unnecessary measures that incur higher trade costs.

The positive impact of the BRI dummy has several policy implications. First, the outcome highlights the importance of higher economic integration in the region. Policymakers need to invest more in transportation projects to boost trade facilitation as strengthening the transportation system will increase the accessibility rate and reduce trade time (He et al., 2021). In addition, international trade will increase, and the market share of natural rubber in the region will be enhanced. Thus, policymakers should not delay the efforts towards achieving this success. Secondly, the policymakers for top exporters should utilize this opportunity to ensure their industries' sustainability and move towards higher value-added products to increase contribution to the domestic and regional economy.

References

Abramovsky, L., & Griffith, R. (2006). Outsourcing and offshoring of business services: How important is ICT? *Journal of the European Economic Association*, *4*(2–3), 594–601. https://doi.org/10.1162/jeea.2006.4.2-3.594

Acemoglu, D., Carvalho, V. M., Ozdaglar, A., & Tahbaz-Salehi, A. (2012). The network origins of aggregate fluctuations. *Econometrica*, *80*(5), 1977–2016. https://doi.org/10.3982/ECTA9623

Allayarov, P., Mehmed, B., Arefin, S., & Nurmatov, N. (2018). The factors affecting Kyrgyzstan's bilateral trade: A gravity model approach. *The Journal of Asian Finance, Economics, and Business*, *5*(4), 95–100. https://doi.org/10.13106/jafeb.2018.vol5.no4.95

Altenburg, T., & Meyer-Stamer, J. (1999). How to promote clusters: Policy experiences from Latin America. *World Development*, *27*(9), 1693–1713. https://doi.org/10.1016/S0305-750X(99)00081-9

Amiti, M., & Wei, S. J. (2005). Fear of service outsourcing: is it justified? *Economic Policy*, *20*(42), 308–347. https://doi.org/10.1111/j.1468-0327.2005.00140.x

Anderson, J. (2011). The gravity model. *Annual Review of Economics*, *3*(1), 133–160. https://doi.org/10.1146/annurev-economics-111809-125114

Ansonfino, A., Zusmelia, Z., Dahen, L. D., & Puteri, Y. E. (2021). Diamond model and competition of rubber export markets: Evidence from Sumatra economic growth center. *Agris On-Line Papers in Economics & Informatics*, *13*(1), 15–27. https://doi.org/10.7160/aol.2021.130102

Balassa, B. (1965). Trade liberalization and "revealed" comparative advantage. *The Manchester School*, *33*(2), 99–123. https://doi.org/10.1111/j.1467-9957.1965.tb00050.x

Balassa, B. (1977). Revealed comparative advantage revisited: An analysis of relative export shares of the industrial countries, 1953 – 1971. *The Manchester School*, *45*(4), 327–344. https://doi.org/10.1111/j.1467-9957.1977.tb00701.x

Balogh, J. M., & Jambor, A. (2018). On the duration of comparative advantages: The case of the European cheese industry. *Bulgarian Journal of Agricultural Science*, *24*(1), 1–7. http://journal.agrojournal.org/

Baltagi, B. H., Egger, P. H., & Pfaffermayr, M. (2014). *Panel data gravity models of international trade* (CESifo Working Paper Series 4616) Munich, Germany: The Center for Economic Studies, Faculty of Economics of the University of Munich. http://hdl.handle.net/10419/93405

Baniya, S., Rocha, N., Nadia, P., & Ruta, M. (2019). *Trade effects of the New Silk Road: A gravity analysis* (Policy Research Working Paper No. WPS 8694). Washington, DC: The World Bank. http://hdl.handle.net/10986/31138

Baquero, J. E., Miranda, S., Murillo, O., Mateus, H., Trujillo, E., Suarez, C., & Parra-López, C. (2006). Reference strand conformational analysis (RSCA) is a valuable tool in identifying MHC-DRB sequences in three species of Aotus monkeys. *Immunogenetics*, *58*(7), 590–597. https://doi.org/10.1007/s00251-006-0101-x

Barone, G., & Kreuter, H. (2021). Low-wage import competition and populist backlash: The case of Italy. *European Journal of Political Economy*, *67*, 101970. https://doi.org/10.1016/j.ejpoleco.2020.101970

Beghin, J. C., Disdier, A., & Marette, S. (2015). Trade restrictiveness indices in the presence of externalities: An application to non-tariff measures. *Canadian Journal* of *Economics*, *48*, 1513–1536. https://doi.org/10.1111/caje.12157

Bertola, P., & Teunissen, J. (2018). Fashion 4.0: Innovating fashion industry through digital transformation. *Research Journal of Textile and Apparel*, *22*(4), 352–369. https://doi.org/10.1108/RJTA-03-2018-0023

Blinder, A. S. (2006). Offshoring: The next industrial revolution? *Foreign Affairs*, *85*(2), 113–128. https://doi.org/10.2307/20031915

Boffa, M., Jansen, M., & Solleder, O. (2021). Participating to compete: Do small firms in developing countries benefit from global value chains? *Economies*, *9*(1), 12. https://doi.org/10.3390/economies9010012

Buck, D., Getz, C., & Guthman, J. (1997). From farm to table: The organic vegetable commodity chain of Northern California. *Sociologia Ruralis*, *37*(1), 3–20. https://doi.org/10.1111/1467-9523.00033

Bucur, A., Dobrotă, G., & Dumitraşcu, O. (2019). Implications of fiscal pressure on the sustainability of the equilibrium and performance of companies. Evidences in the rubber and plastic industry from Romania. *Sustainability*, *11*(7), 2082. https://doi.org/10.3390/su11072082

Burianova, J., & Belova, A. (2012). The competitiveness of agricultural foreign trade commodities of the CR was assessed by way of the Lafay Index. *Agris on-line Papers in Economics and Informatics*, *4*(4), 27–36. https://doi.org/10.22004/ag.econ.146274

Capobianco-Uriarte, M. D. L. M., Casado-Belmonte, M. D. P., Marín-Carrillo, G. M., & Terán-Yépez, E. (2019). A bibliometric analysis of international competitiveness (1983–2017). *Sustainability*, *11*(7), 1877. https://doi.org/10.3390/su11071877

COMTRADE. (2021). *International trade statistics database*. from: https://comtrade.un.org/

Dalum, B., Laursen, K., & Villumsen, G. (1998). Structural change in OECD-export specialization patterns: De-specialization and 'stickiness'. *International Review of Applied Economics*, *12*(3), 423–443. https://doi.org/10.1080/02692179800000017

De Benedictis, L., & Tamberi, M. (2004). Overall specialization empirics: techniques and applications. *Open Economies Review*, *15*(4), 323–346. https://doi.org/10.1023/B:OPEN.0000048522.97418.99

Durand, M., & Giorno, C. (1987). Indicators of international competitiveness: conceptual aspects and evaluation. *OECD Economic Studies*, *9*(3), 147–182. https://www.

econbiz.de/Record/indicators-of-international-competitiveness-conceptual-aspects-and-evaluation-durand-martine/10001036049

Fagerberg, J. (1988). International competitiveness. *The Economic Journal*, *391*, 355–374. https://doi.org/10.2307/2233372

Falciola, J., Jansen, M., & Rollo, V. (2020). Defining firm competitiveness: A multi-dimensional framework. *World Development*, *129*, 104857. https://doi.org/10.1016/j.worlddev.2019.104857

FAO. (2020). *Food and agriculture organization*. http://faostat3.fao.org/browse/rankings/countries_by_commodity/E

Feenstra, R. C., Markusen, J. R., & Rose, A. K. (2001). Using the gravity equation to differentiate among alternative theories of trade. *Canadian Journal of Economics, 34*(2), 430–447. https://doi.org/10.1111/0008-4085.00082

Gapkindo, R. (2016). *Indonesian rubber statistics*. Jakarta, Indonesia: Rubber Association of Indonesia.

Gençtürk, E. F., & Kotabe, M. (2001). The effect of export assistance program usage on export performance: a contingency explanation. *Journal of International Marketing*, *9*(2), 51–72. https://doi.org/10.1509%2Fjimk.9.2.51.19886

Ghazali, M, F., Lean, H, H., & Bahari, Z. (2015). Is gold a good hedge against inflation? Empirical evidence in Malaysia. *Kajian Malaysia*, *33*(1), 69–84. https://doi.org/10.7160/kml.2017.090303

Görg, H., & Mao, H. (2020). *Does the belt and road initiative stimulate Chinese exports? The role of state-owned enterprises* (K.C.G. Working Paper No. 21). Germany: Kiel Centre for Globalization (KCG). http://hdl.handle.net/10419/213420

He, Y., Choi, B. R., Wu, R., & Wang, Y. (2021). International logistics: Does it matter in foreign trade? *The Journal of Asian Finance, Economics, and Business*, *8*(2), 453–463. https://doi.org/10.13106/jafeb.2021.vol8.no2.0453

Head, K., & Mayer, T. (2013). Gravity equations: Toolkit, cookbook, workhorse. In G. Gopinath, E. Helpman, & K. Rogo (Eds.), *Handbook of international economics* (pp. 131–195). Amsterdam, The Netherlands: Elsevier. https://doi.org/10.1016/B978-0-444-54314-1.00003-3

Helleiner, G. K. (1991). Increasing international competitiveness: A conceptual framework. In Y. & J. Sengupta (Eds.), Increasing the international competitiveness of exports from Caribbean countries. Washinton DC: Economic Development Institute, World Bank. https://doi.org/10.1596/978-1-4648-0049-8

Hoang, V. V. (2020). Investigating the agricultural competitiveness of ASEAN countries. *Journal of Economic Studies*, *47*(2), 307–332. https://doi.org/10.1108/JES-10-2018-0366

Huo, D., Chen, Y., Hung, K., Song, Z. Guan, J., & Ji, A. (2019) Diamond model and the export competitiveness of the agriculture industry from emerging markets: An exploratory vision based on a spatial effect study using a genetic algorithm. *Economic Research-Ekonomska Istrazivanja, 33*(1), 2427–2443. https://doi.org/10.1080/1331677X.2019.1679212

Iqbal, B. A., Rahman, M. N., & Sami, S. (2019). Impact of Belt and Road Initiative (BRI) on Asian Economies. *Global Journal of Emerging Market Economies*, *11*(3), 260–277. https://doi.org/10.1177%2F0974910119887059

Jaffee, S., & Henson, S. J. (2004) *Standards and agri-food exports from developing countries: Rebalancing the debate* (World Bank. Policy Research Working Paper 3348). Washington DC: The World Bank. http://hdl.handle.net/10986/14061

Jagdambe, S., & Kannan, E. (2020). Effects of ASEAN-India Free Trade Agreement (FTA) on agricultural trade: The gravity model approach. *World Development Perspectives*, *19*, 100212. https://doi.org/10.1016/j.wdp.2020.100212

Kennedy, S. F., Leimona, B., & Yi, Z. F. (2017). Making a green rubber stamp: emerging dynamics of natural rubber eco-certification. *International Journal of Biodiversity Science, Ecosystem Services & Management*, *13*(1), 100–115. https://doi.org/10.1080/21513732.2016.1267664

Kersan-Škabić, I. (2019). The drivers of global value chain (GVC) participation in EU member states. *Economic Research-Ekonomska Istraživanja*, *32*(1), 1204–1218. https://doi.org/10.1080/1331677X.2019.1629978

Kreinin, M. E., & Plummer, M. G. (1994). Structural change and regional integration in East Asia. *International Economic Journal*, *8*(2), 1–12. https://doi.org/10.5172/iej.8.2.012

Lee, E., & Yi, K. M. (2018). Global value chains and inequality with endogenous labor supply. *Journal of International Economics*, *115*, 223–241. https://doi.org/10.1016/j.jinteco.2018.09.006

Lundmark, R. (2018). Analysis and projection of global iron ore trade: A panel data gravity model approach. *Miner Economics*, *31*, 191–202. https://doi.org/10.1007/s13563-017-0125-8

Mandeng, O. J. (1991). International competitiveness and specialization. *CEPAL Review*, *45*, 39–52. https://doi.org/10.1007/s10842-006-8430-x

Mayer, T., & Zignago, S. (2011). Notes on CEPII's distances measures: The GeoDist database (CEPII Working Paper No. 2011–25). Munich Germany: Munich Personal RePEc Archive (MPRA). https://mpra.ub.uni-muenchen.de/36347/

McCallum, J. (1995). National borders matter: Canada-U.S. regional trade patterns. *American Economic Review*, *85*(3), 615–623. https://www.jstor.org/stable/2118191

Mesike, C. S., & Esekhade, T. U. (2014). Rainfall variability and rubber production in Nigeria. *African Journal of Environmental Science and Technology*, *8*(1), 54–57. https://doi.org/10.5897/AJEST2013.1593

Mesquita, L., Lazzarini, S. G., & Cronin, P. (2007). Determinants of firm competitiveness in Latin American emerging economies: Evidence from Brazil's auto-parts industry. *International Journal of Operations and Production Management*, *27*(5), 501–523. https://doi.org/10.1108/01443570710742384

Murray, D. L., & Raynolds, L. T. (2000). Alternative trade in bananas: Obstacles and opportunities for progressive social

change in the global economy. *Agriculture and Human Values*, *17*(1), 65–74. http://doi.org/10.1023/A:1007628709393

Nair, S. T. G. (2021). Measuring volatility spillovers and asymmetric responses of Agri commodity prices: evidence from spices and rubber futures in India. *Indian Growth and Development Review, 14*(2), 242–267. https://doi.org/10.1108/IGDR-10-2020-0147

Nguyen, H. M., Quan, B. Q. M., Le, H. V., & Tran, T. V. (2020). Determinants of intra-industry trade between Vietnam and countries in TPP. *The Journal of Asian Finance, Economics, and Business*, *7*(1), 123–129. https://doi.org/10.13106/jafeb.2020.vol7.no1.123

Nin, A., Ehui, S., & Benin, S. (2007). Livestock productivity in developing countries: An assessment. In R. Evenson & P. Pingali (Eds.), *Handbook of agricultural economics* (pp. 2461–2532). The Netherlands: Academic Press.

Njinyah, S. Z. (2018). The effectiveness of government policies for export promotion on the export performance of SMEs Cocoa exporters in Cameroon. *International Marketing Review*, *35*(1), 164–185. https://doi.org/10.1108/IMR-05-2016-0103

Setiawan, H. (2012). Technology innovation roadmap to the industrial development of rubber-raw material in South Sumatera: Ergonomics SHIP approach & appropriate technology point of view. *Procedia Economics and Finance*, *4*, 255–263. https://doi.org/10.1016/S2212-5671(12)00340-1

Silva, J. S., & Tenreyro, S. (2006). *The log of gravity* (CEP Discussion Papers No. dp0701). London: Centre for Economic Performance. http://eprints.lse.ac.uk/3744/1/The_Log_of_Gravity.pdf

Silva, J. M. C. S., & Tenreyro, S. (2011). *Further simulation evidence on the performance of the Poisson Pseudo-Maximum Likelihood estimator* (CEP Discussion Papers No. dp0933). London: Centre for Economic Performance. http://eprints.lse.ac.uk/25506/1/Further_Simulation_Evidence_on_the_Performance_of_the_Poisson_Pseudo-Maximum_Likelihood_Estimator.pdf

Stellinger, A., Berglund, I., & Isakson, H. (2020). *How trade can fight the pandemic and contribute to global health*. London, UK: CEPR Press.

Svatos, M., Smutka, L., & Miffek, O. (2018). Competitiveness of agrarian trade of EU-15 countries in comparison with new EU member states. *Agricultural Economics*, *56*(12), 569–582. https://doi.org/10.17221/129/2010-AGRICECON

Tanielian, A. R. (2018). Sustainability and competitiveness in Thai rubber industries. *The Copenhagen Journal of Asian Studies*, *36,* 12–55. https://doi.org/10.22439/cjas.v36i1.5512

Tham, S. Y., Goh, S. K., Wong, K. N., & Fadhli, A. (2018). Bilateral export trade, outward and inward FDI: A dynamic gravity model approach using sectoral data from Malaysia. *Emerging Markets Finance and Trade*, *54*(12), 2718–2735. https://doi.org/10.1080/1540496X.2017.1402176

Tinbergen, J. M. (1962). *Shaping the world economy: Suggestions for an international economic policy*. New York: The Twentieth Century Fund. https://doi.org/10.2307/1236502

Török, Á. (2008). Export competitiveness and the catch-up process of Hungary (1996-2001): A comparative analysis with some reflections on trade theory. *Competitiveness Review: An International Business Journal, 18*(1/2), 131–153. http://doi.org/10.1108/10595420810874646

UNCTAD. (2021). *Data on non-tariff measures*. https://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures.aspx

Vollrath, T. (1991). A theoretical evaluation of alternative trade intensity measures revealed comparative advantage. *Review of World Economics*, *127*(2), 265–280. https://doi.org/10.1007/BF02707986

Wood, J., Wu, J., Li, Y., & Kim, J. (2019). The impact of TBT and SPS measures on Japanese and Korean exports to China. *Sustainability*, *11*(21), 6141. https://doi.org/10.3390/su11216141

World Bank (2021). *World development indicator*. https://databank.worldbank.org/source/world-development-indicators?l=en

Yu, X., Luo, H., Wang, H., & Feil, J. H. (2020). Climate change and agricultural trade in Central Asia: Evidence from Kazakhstan. *Ecosystem Health and Sustainability*, *6*(1), 1766380. https://doi.org/10.1080/20964129.2020.1766380

Zainuddin, M. R. K., Sarmidi, T., & Khalid, N. (2020). Sustainable production, non-tariff measures, and trade performance in RCEP countries. *Sustainability*, *12*(23), 9969. https://doi.org/10.3390/su12239969